Growth and characterization of metallic and oxidized forms of bismuthene

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Bismuth is in the XVth group of the periodic table, with the electronic configuration $6s^2 6p^3$, and as a semi-metal it is the last non-radioactive element in the periodic table with unusual electronic properties.

These properties are of interest due to spin-orbital effects and surface and edge states.[1] It was in bismuth that many quantum phenomena such as, for example, magnetoresistance, quantum size effects and recently also topologically protected edge states were first detected. It was recently shown that bismuth can grow in two dimensional form material known as bismuthene.[1,2] It is extremely important to understand the growth and degradation paths of these new material.

We will present the properties and morphology of bismuth nanostructures growing epitaxially on a pyrolytic graphite (HOPG), as well as insulating materials such as mica and hBN, on which the growth of bismuthene islands (2D bismuth with black phosphorus structure) can be observed.

We will focus on the conducted experimental research using scanning tunneling microscopy and atomic force microscopy, thanks to which we were able to study the electronic and atomic structure of bismuth single layers. X-ray photoelectron spectroscopy was used to investigate and determine the chemical composition of the oxidized structures. Raman spectroscopy was used for further analysis of the oxidized and metallic structures.

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